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Method of automatically sorting thin sheets

Patent Claims

1. Method of automatically sorting thin sheets, especially securities, currency bills and the like, wherein the individual sheets of a processing unit, e.g. a package, are successively withdrawn from a stack, transferred into a transport system, checked for different criteria, divided into rotatable, non-rotatable and undeterminable cases in response to said check, and wherein said undeterminable cases are stored in an intermediate storage during the sorting process, characterized in that

   - a data record providing information at least on the undeterminable cases is set up in a data memory (357),
   - a manual refinish protocol containing all data relating to the undeterminable cases is set up,
   - the undeterminable cases from the intermediate storage (29b) are manually or visually checked and sorted at a manual refinish place (8) on the basis of the manual refinish protocol independently of the continued automatic sorting process, wherein the manual refinish place (8) is provided with a data input device (359) and a printer (361) and comprises a data communication device for the communication between the manual refinish place (8) and the data memory (357),
   - the result of this check is inputted by the data input device (359) for supplementing the data record in the data memory (357).

2. Method according to claim 1, characterized in that the data record providing information at least on the undeterminable cases is transmitted into a long-term storage (357).

3. Method according to claim 1, characterized in that the undeterminable cases are physically stored in a transportable intermediate storage (29b).

4. Method according to claim 3, characterized in that the undeterminable cases relating to a processing unit are stored in separate pockets provided with codings of a transportable intermediate storage (29b).

5. Method according to claim 3 or 4, characterized in that the revenue stamp pertaining to the processing unit in question is stored together with the undeterminable cases.

6. Sorting device for performing the method according to claim 1 or 2, characterized in that the manual refinish place (8) is provided as a periphery unit and comprises
   - a data input device (359),
   - a printer (361) and
   - a data communication device to the automatic sorting device.

7. Sorting device for performing the method according to one or more of claims 1 to 5, characterized in that a transportable storage (29b) is provided as intermediate storage for receiving the undeterminable cases.

8. Sorting device according to claim 7, characterized in that the transportable intermediate storage (29b) comprises pockets provided with codings.

Description

The invention relates to a m thod of automatically sorting thin sheets, especially securities, currency bills and the like, wherein the individual sheets of a processing unit, e.g. a package, are successively withdrawn from a stack, transferred into a transport system, checked for different criteria, divided into rotatable, non-rotatable and undeterminable cases in response to said check, and wherein said undeterminable cases are stored in an intermediate storage during the sorting process.

The unexamined German patent application DE 24 46 280 discloses a currency bill sorting device by means of which large quantities of currency bills of a predetermined value and a predetermined currency can be checked as to whether they are still usable for the continued currency bill circulation, or whether they have to be removed from said circulation and destroyed, if required. Currency bills of another currency or another value are recognized to be invalid and are stored separately.

For performing said sorting processes the currency bills delivered by the banks in packages of hundred and secured by a revenue stamp are manually freed from the revenue stamp, individualized package by package by so-called sorting cards and placed into an input station, individualized, checked and stored in different stacking pockets. The storage is performed according to three criteria: "normal" (neither invalid nor dirty), "dirty" and "unusable" (e.g. invalid, successive in too little time) currency bills.

For being able to subsequently reconstruct possible irregularities in a package or, respectively, for being able to allocate possible errors in the package of the pertinent revenue stamp, on which the bank from which the package comes is noted,

1. the packages of hundred are individualized in the input station of the sorting device by so-called separating cards,
2. the revenue stamps, when removed manually, are provided with machine-internal information and are inputted in a mechanical serial storage in the order in which they are processed, and

3. th machine-internal data of the rev nue stamp are recorded on a magnetic stripe of the pertinent separating card (only package numb r in input magazine).

By reading the separating card data and by finding out the revenue stamp, the reconstruction of the packages is, in principle, possible.

For largely automatizing the sorting process, moreover,

- the package number of the inputted stack, the number of the invalid currency bills (wrong currency, wrong value) as well as
- based on binary information, the information as to whether the passage could be concluded without any irregularities

are noted on the separating card.

After the sorting, during which the non-rotatable currency bills were provided with a corresponding print, the currency bills each collected at hundreds are passed, stack by stack, over a conveying belt to a revenue stamp station, in which the stacks are provided with new revenue stamps and, in response to their quality, are recirculated or withdrawn. The unusable currency bills are stacked together with the corresponding sorting cards in a special collector and, once the collector is filled, are individually fed to the sorting device again.

Although the previously only manually performed sorting process is provided with an essential automation by the known sorting device, the sorting device shows some substantial drawbacks. This especially relates to the process when false sums are detected, and to the processing of undeterminable or unusable cases.

If, for instance, a false sum like one being too small or too big in comparison with a predefined number is detected, all currency bills are manually removed from the collectors and are stored in a special collector – the waste currency bill box.

As soon as one of the collectors for waste currency bills or for unusable currency bills is filled, the normal sorting process for the processing of said currency bills has to be

interrupted. The currency bills located in said collectors, and the corresponding sorting cards, are individually inputted by hand for the processing thereof in the sorting device. If, during this check, a false sum is detected, or if the state of a currency bill cannot doubtlessly be determined, the entire sorting device is blocked and can be restarted only by means of a key kept by a responsible operator.

The processing of the unusable cases or, respectively, of the currency bills from the waste currency bill box, therefore, requires in principle that the normal sorting operation has to be interrupted, which reduces the throughput to a considerable extent.

Therefore, it is the object of the invention to provide a sorting process which reduces interruptions during the working process and allows a higher throughput.

The object is provided by the features described in the characterizing part of the main claim.

The undeterminable cases are transferred into an intermediate storage and, for the continued processing and completion of the data record set up in the sorting device, are removed from the continuing automatic sorting and checking process. The procssing or, respectively, the final classification of the undeterminable cases is performed in a peripheral unit of the sorting device – the manual refinish place (HN place). At this HN place the currency bills from the intermediate storage are checked visually and manually. The HN place is provided with a data input device and a printer and comprises a data communication device for the communication with the automatic sorting device, so that the result of the check can be transmitted into the data memory for the purpose of completing the data record of the sorting device. A manual refinish protocol previously provided by the printer serves as the basis for the manual refinish, whereby said protocol contains at least all present relevant data relating to the undeterminable cases (HN-BN).

It is particularly advantageous, if the intermediate storage for receiving the undeterminable cases is constructed as a transportable element comprising individual coded pockets, into which the undeterminable cases pertaining to a processing unit are stored, possibly with the revenue stamp pertaining to said processing unit.

An essential advantage of the method according to the invention r sides in the completely physical, but not data-technical, uncoupling or th processing of the und t rminable cases from the automatic sorting and checking process. The undeterminable cases can be processed in parallel or at different times at the HN place, so that – in contrast to the prior art process – a substantially higher throughput is obtained. At the same time, the data-technical coupling guarantees a troublefree and easy completion of the protocols, so that a reconstruction of the sorting process in view of each single currency bill is possible also at a later time.

Another advantage of this method resides in that it is particularly flexible in view of different nonproductive working processes. Thus it is, for instance, possible that the entire currency bill processing of currency bills to be processed during a working period (shift) lasting approximately eight hours can completely be managed by one single operator, up to the generation of the final protocols, in that the operator only looks after the automatic sorting device during the first six hours and performs the manual refinish (HN) processing during the last two hours. During the HN processing the sorting device is, however, already free again for the subsequent operator, so that delay times of the automatic sorting device can almost completely be avoided.

On the other hand it is, of course, likewise possible that the HN processing is performed by a second operator, or only at a later time. Due to the data communication coupling the complete protocol generation is guaranteed in any case, independently of the time of the HN processing, without interfering with the throughput of the sorting device in any way.

Additional features and advantages of the invention can be inferred from the dependent claims. The invention is described in the form of an embodiment in the form of a currency bill sorting device by means of the figures, wherein

Fig.1 shows a block diagram of the new sorting device with the information-processing system,

Fig. 2 shows the transport unit including the individual components,

Fig. 3 shows a block diagram of the information-processing system,

Fig. 4 shows the transport unit with the light barriers and sensors in question,

Fig. 5 shows the configuration of the data record,

Fig. 6 shows a file for the data records (currency bill features),

Fig. 7 shows a decision table,

Fig. 8. shows a schematic illustration "section filling",

Fig. 9 shows a schematic illustration "execution time surveillance",

Fig. 10 shows a flow chart "stacker selection",

Fig. 11 shows a flow chart "switch control", and

Fig. 12 shows a schematic illustration "synchronism check"

General description (fig. 1)

According to fig. 1 the currency bill sorting device 1 comprises three essential system units: the transport device 2, the transport control unit 6 and the system control unit 7 including the peripheral units 8, 9.

The transport unit 2 being a purely mechanical system unit is, thereby, responsible for the movement of the currency bill packages, currency bills and revenue stamps. It takes up the input packages (e.g. of 100 currency bills each) packed in package magazines and secured with revenue stamps in a receiving and provision unit 3, separates the packages from the magazines and removes the revenue stamps. The stacks, from which the revenue have been removed, are thereupon individualized and passed through a checking unit 4 by means of a currency bill transport system, in which checking unit each currency bill is individually checked in view of its genu-

inen ss and stat by means of several checking devices. A sorting d vice 5 joins the checking unit 4, which comprises three different sorting classes. One class for non-rotatable currency bills (NU-BN), one class for rotatable currency bills (U-BN) and, finally, one class for currency bills that need to be manually refinished (HN-BN). The latter includes, for example, currency bills which are suspected to be counterfeit, strongly damaged or non-identifiable. Apart from irregularities in view of certain currency bills, also irregularities in view of the number of the packages are possible.

Corresponding switches are provided inside the sorting unit 5, which allocate the individual currency bills to the aforementioned sorting classes in response to the result from the checking device 4.

The revenue stamps resulting from the removal of the revenue stamps from the packages are received in a revenue stamp transport system separated from the currency bill transport system, and are allocated in the same, by means of intermediate storage, to the pertinent package until the pertinent package is fully processed, i.e. until all currency bills of the package have left the currency bill transport system and, thus, have been stored in one of the aforementioned sorting classes. If there had been even only one irregularity in view of the processed package, the revenue stamp is likewise stored, via the revenue stamp transport system, in the sorting class for currency bills that need to be refinished manually. Thus, the direct physical allocation of the revenue stamp to the package, in which the irregularity had occurred, is guaranteed at all times.

Apart from the above-described mechanical system (transport unit 2), the information-processing system including the system units of the transport control unit 6 (S) and the system control unit 7 have to be mentioned as the second component of the sorting device 1. The transport control unit 6 monitors and controls the flow of the currency bill packages, the currency bills and the revenue stamps through the transport unit 2. It thereby processes the results measured in the checking unit 4, detects the sorting classes relevant for the checked currency bills on the basis of the results, tracks each currency bill located in the currency bill transport system in view of the path determined by the checking unit 4 and finally takes care that the allocation of the

currency bills to the corresponding input package as well as to the corr sponding revenue stamp is maintained at any tim .

In contrast to the transport control unit 6, which monitors and controls the current currency bill packages, currency bills and revenue stamps, i.e. the ones being located in the transport unit 2 at this time, the system control unit 7 performs with its peripheral units, namely manual refinish place 8 and operating panel 9, the entire organization of the currency bill processing over a longer operation period (shift). It receives and administers all data set up during a processing period and provides for the observation of a working process specified according to organizational provisions. It generates, if necessary, protocols from the received data (e.g. the manual refinish protocol on the manual refinish place 8), and is capable of communicating with the operator of the sorting device 1 via the operating panel 9.

After the general description of the currency bill sorting device 1, the transport unit 2, the transport control unit 6 and the system control unit 7 including its peripheral units 8, 9, shall now successively be explained in more detail.

Transport unit (fig. 2)

The transport unit 2 consists of nine components 10-18. It is illustrated in fig. 2 by means of an example and comprises the following components:

- Component 10 for individualizing the currency bill packages supplied in sealed package magazines 19 and for removing the revenue stamps therefrom,
- Component 11 for individualizing the currency bills of the currency bill stacks, from which the revenue stamps have been removed, by means of a separator 20, as well as for a preliminarily check and, if required, for the reconstructable rejection of those currency bills into a first rejection magazine 29a, whereof the flow through the transport unit 2 may damage the subsequent units,
- Component 12 for checking the currency bills in view of their rotating ability (general state, e.g. degree of impurity), in a first checking section 22, as well as in view of their genuineness (suspected counterfeit money due to defective or absent genuineness features) in a second checking section 23,

- Component 13 for the irreversible destruction of genuine, non-rotatable currency bills (NU-BN) by means of double shredder system 24 and the collection of the formed chips in a chip container 25,
- two identically structured components 14, 15, operating in tandem operation, for stacking and depositing, after the removal of the revenue stamps, non-rotatable currency bills (NU-BN) in corresponding containers 26, 27,
- two identically structured components 16, 17, likewise operating in tandem operation, for stacking and depositing, after the removal of the revenue stamps, rotatable currency bills (U-BN) in a revenue stamp station 28, and
- Component 18 for the reconstructable storage of currency bills to be processed separately including the corresponding revenue stamp in a second rejection or manual refinish magazine (HN magazine) 29b as well as for the collection of those revenue stamps that belong to the unobjected currency bill packages.

The structure of the entire system is a modular one. All components 10-18 performing the transport, checking and sorting functions in view of the currency bills, revenue stamps or currency bill packages are constructed in a uniform manner as far as their mechanical and their electrical interfaces are concerned, i.e. they are standardized. This allows, on one hand, the individual selection as well as the combination of individual components and, thus, the adaptation to different requirements in view of the organization of the processing of the currency bills and, on the other hand, the adaptation to the specific features of different currency bill types and currencies.

As is outlined in fig. 2 by means of flow lines, the transport unit 2 comprises two transport systems not depending on each other and extending over all components 10-18, namely currency bill transport system 30 and the revenue stamp transport system 32. On the basis of component 10 for the individualization of the packages, the currency bill transport system 30 thereby transports the individual currency bills more or less from the package magazine 19, via components 10, 11, through the individual checking stations 22, 23 of component 12 towards the respective destinations of the sorting components 13-18 which were determined in the checking stations. As can be seen from the branches 31b-31g inside the sorting components 13-18, the transport of the individual currency bills – in response to the sorting compo-

nent in which they are stored - may be of a very different length, which makes particular demands on the transport control and the transport monitoring.

Apart from the sorting branches 31b-31g provided in the sorting components 13-18, component 11 comprises another branch 31a already at the beginning of the currency bill transport, in which those currency bills are sorted out which may damage the subsequent units.

The revenue stamp transport system 32 arranged above the currency bill transport system 30 is likewise based on component 10. In contrast to the currency bill transport system 30, however, it comprises a branch 33 only in the last component 18.

Information-processing system (fig. 1, 3)

After the general description of the transport unit 2 – of the mechanical system – the information-processing system (6, 7, 8, 9) of the sorting device 1 shall now be explained in more detail.

In correspondence with the block diagram shown above in fig. 1, fig. 3 shows the transport control unit 6 and the system control unit 7 with the peripheral units 8, 9 as main components of the information-processing system in a detailed form.

Tasks of the transport control unit

The transport control unit has the following tasks within the information-processing system:

- It receives all results from sensors 22, 23 along the test path (see fig. 2) in view of the genuineness and the state of the currency bills and combines them – in allocation to the respectively checked currency bill – in a data record.
- After a currency bill has been passed through the test path 22, 23 it generates, by a logical operation, a so called evaluation byte for the respective currency bill, which – likewise stored in the data record – serves to derive the stacking

criteria and, thus, (fig. 2) the selection of one of the sorting components or destinations (components 13-18).

- It moreover tracks each currency bill located in the transport system in correspondence with the destinations specified in the data record, whereby irregularities and deviations from the predefined transport paths are registered so as to stop the sorting process, if necessary.
- It moreover takes care that the allocation of the currency bills just being processed and having been finally processed to the corresponding input package and to the corresponding revenue stamp is maintained at any time. If an objection occurs, the revenue stamp and the currency bills concerned are combined in a pocket of the manual refinish magazine (2. reject magazine).
- It finally controls all peripheral units set up as sequence controls, such as the control of the package individualization (component 10).

Tasks of the system control unit

The system control unit 7 fulfills the following tasks in view of the information-processing system:

- It detects the data supplied by the sorting device and stores them in a long-term storage.
- It processes the adopted data to form different protocols and accounting documents, e.g.
  manual refinish protocols,
  protocols on interferences and malfunctions,
  statistics on the function of the currency bill sorting device.
- It performs operator instructions for controlling the working sequence, e.g.
  beginning of the shift,
  output of information on the state of the plant,
  specific procedures for removing malfunctions during the operation,
  end of the shift.
- Via the peripheral units (HN place 8 and operator panel 9) it has the possibility to print the listed protocols and to receive instructions from the operating staff (operator instructions).

Configuration of th transport control unit (fig. 4)

For managing the aforementioned tasks in view of the transport control unit 6, the same is – as is shown in fig. 3 – subdivided into four subsystems 345-348. Each subsystem is characterized by one or more data sources, such as the sensors S0-S8 or light barriers (85a ..., 86a ...) and by one or more data sinks, such as data memories (files D_1 ... D_6) or control lines for controlling the switches (83a ...).

Some of the data sources (light barriers, sensors), or also data sinks (control lines for controlling the switches) have, in view of the geometric structure of the sorting device 1, to be associated with the transport unit 2 (fig. 4). From an information-processing view, the above- mentioned data sources or data sinks are, however, elements of the subsystems 345, 346, 347 and 348 of the transport unit and are, thus, also shown as pertaining to said unit in the following.

A main memory 349 common for all systems, to which also the system control unit 7 has access – as is explained below – is a memory with small capacity, which only temporarily stores its data during the operation. It comprises a file (D_1) for currency bill features 350 and a file (D_6) for events 351 relating to the peripheral processes of the sorting device 1. Part thereof is, for instance, the message that empty manual refinish magazines 29b are provided in due time, so that the sorting process does not have to be interrupted.

The transport control unit 6 configured as multi-processor system comprises a microprocessor (μP_1 - μP_4, 352-355) as mediation device between the data sources and the data sinks of each subsystem, which controls the occurring data flow of the respective system. All microprocessors 352-355 are centrally pulsed by a timing generator 356 so as to allow the access to the common main memory 349.

Description of the subsystems of the transport control unit (fig. 3)

The tasks of the subsystems 345-348 of the transport control unit will now be described in the following order:

- First subsystem 345: General check of the currency bills, storing and evaluating the results.
- Second subsystem 346: Monitoring the currency bill transport.
- Third subsystem 347: Monitoring the revenue stamp transport.
- Fourth subsystem 348: Controlling the peripheral units of the currency bill sorting device 1.

First subsystem 345 of the transport control unit (fig. 3, 4, 5, 6, 7)

The first subsystem 345 individually detects test results formed during the passage of each currency bill through the sensors S0 (component 11) or S1-S8 (component 12), stores the same and detects, on the basis of the test results, the destination (sorting components 13-18 or reject pocket 29a) of the currency bill coming into question.

The first subsystems 345 consists of

- a block acting as data source, in which the rejection sensor S0, the state sensors S1-S4 and the genuineness sensors S5-S8 are combined,
- the file for currency bill features (D_1) 350 used together with the other subsystems, which can be regarded as both, data source and data sink, and in which the data provided by the sensors S0-S8 are intermediately stored.
- a decision file D_3 365, and
- a microprocessor (μP_1) 352 by which the data flow between the data sources and the data sinks within the subsystem 345 is regulated.

In the interaction of data sources, data sensors and microprocessor a data record to be explained later is generated for each currency bill during the passage of the same, which contains all information necessary for the sorting process and for the printout.

The compilation of a data record 366 schematically illustrated in fig. 5 takes place simultaneously with the passage of the currency bills. As is shown in fig. 5, the following information are thereby stored in each data record:

- the number of the package (P.-No.) to which th currency bill to be sorted belongs,
- the test results of sensors S0-S8 successively stored in correspondence with the passage of the currency bills through the sensors,
- the evaluation information (A.-byte) in which the results from sensors S1-S8 are combined (the A.-byte) is generated when the respective currency bill has passed sensor S8 in component 12. Available results from S0 had already been processed previously).
- the "desired stacker" decisions (SD, NU, U, HN) providing information on the destinations (components 13-18) of the checked currency bills coming into question, and
- the "actual stacker" decisions (SD, NU, U, HN) providing information on the performance of the storage in one of the desired destinations in view of a currency bill.

All data records are stored in file (D1) 350 for currency bill features (fig. 3) and are kept available at least until all currency bills pertaining to one package have properly been processed or, respectively, until the processing of a package has been concluded.

For being able to operate the sorting device also in an overlapping mode, in which the last currency bills of a package are still positioned in the transport path, while the first currency bills of the subsequent package are already individualized, the file (D_1) 350 should have space at least for the data records of two currency bill packages, i.e. 200 locations. The provision of 256 memory locations provided in the file (D_1) 350 moreover also allows the processing of those cases, in which the packages contain more that the permitted number of currency bills.

The configuration of the file required for fulfilling the memory tasks as requested is illustrated in fig. 6 by means of a three-dimensional memory drum.

Each point of the cylindrical surface is thereby defined by the cylinder coordinates of the angle φ and length l. The data of the currency bills are arranged on longitudinal lines of the cylindrical surface data record by data record such that a currency bill is

allocated to a value of φ and a specific information type is allocated to a value l inside the data record, .g. the measured result from a sensor. The number of respectively checked currency notes are as such not provided in the data record. They are, however, indirectly determined by the values of the angles φ. Therefore, each information type in the data record can be associated with a pointer (e.g. 367a for P.-No.) of a pointer field, which is clearly defined by its position of the point of rotation on the cylinder axis (significant for the affiliation of a pointer to a special information type) and its respective angle 369 (significant for the data record of the currency bill in question). Thus, each address of the memory can be selected by the sum of pointers 367a ... which are independent of each other.

The movement of the pointers 367a ... takes place cyclically, so that, on the basis of an output value after 256 steps, i.e. after the processing of 256 currency bills and, thus, data records, the output value is automatically reached again. This means, if the data records of 256 currency bills are stored, the oldest data record in the memory is cancelled for the processing of a newly fed currency bill. Since, with 256 memory locations, the file is configured such that it can safely store its data until all currency bills pertaining to a package have properly been processed, a continuous data administration is feasible.

The collection of the information pertaining to a data record thus takes place by storing the data formed when a currency bill is passed through the transport unit, namely in the memory locations of the data records of the file defined by the angle position of the respective pointers 367a ... .

The rotation of the individual pointers into the respective angle position is thereby effected by test probes allocated to said pointers, which – being distributed in the transport system – register the currency bills when the same pass through. Test probes are the light barriers 85a, 85b ... in the currency bill transport system, and the light barriers (not illustrated in more detail in the drawings) located in the sensors S0-S8.

The light barriers are each provided at those locations of the transport system, at which information necessary for the data record of the currency bills are formed. On

the basis of a defined initial state the pointer allocated to a test probe is now advanced by one as soon as the test probe has registered a currency bill. For guaranteeing th correct advanced switching of the pointers 367a, 367b ... for subsequent currency bills in cases, where a currency bill has left the transport system prior to reaching a test probe, e.g. when it is stored in a sorting component provided in front of the same, the corresponding pointers will – as is described later – be switched on correspondingly also without the registration of said currency bills. This secures that the very first allocation of the data record for all currency bills is maintained during the entire through-passage.

In the following, the creation of a data record 366, when a currency bill passes through the sensors S0-S8 (fig. 4) is explained in more detail, whereby it is assumed that no currency bill is located in the transport unit 2, the file (D_1) 350 is deleted and all pointers 367a, 367b ... are in a defined initial position.

Upon the first registration of a currency bill by the light barrier 85a directly after the individualization the memory location necessary for setting up a new data record is reserved in the file for currency bill features 350. This situation is illustrated in fig. 6 by a data record 366 schematically shown on the lateral area of the cylinder. Said data record belongs, starting out from the above-explained pointer field of the file, to the currency bill no. 1, as the pointer 367a of the light barrier has skipped from "0" to "1" upon the arrival of the front edge of currency bill 1. The "zero position" should thereby be defined as that position, which adopts in fig. 6 the pointers 367b, 367c, 367d etc. In correspondence with the position of the point of rotation of pointer 367a on the cylinder axis the package no. (P.-No.) to which the registered currency bill belongs, is now registered in the data record 366 as first information. In the further course the currency bill passes sensor S0. The activation of the light barrier in the sensor S0 (not shown) switches the corresponding pointer 367b likewise in the position "currency bill 1", whereupon the test result of the sensor S0 is stored in the location of the data record correspondingly marked in fig. 6. It is assumed that there is no case of rejection, so that the currency bill enters the subsequent component 12 of the transport unit 2 and passes the testing sensors S1-S8 one after the other. During the passage through the sensors S1-S8 the pointers allocated to them 367c, 367d etc.

are each set into the position "currency bill 1" and the obtained test results are subsequ ntly stored in the corresponding locations in the data record.

When the currency bill in question has passed the last sensor S8, which is registered by the light barrier provided in the last testing sensor, the following operations are carried through until the currency bill enters the subsequent components (fig. 4):

- Generation of an evaluation information (A.-Byte) based on the test results from sensors S1-S8.
- Derivation of the destinations (selection of one of the components 13-18) for the respective currency bill with the aid of the evaluated information and a decision table stored in the decision file (D3) 365.

The generation of an evaluation information consists, in principle, of the summary of the test results from the individual sensors S1-S8. The result from sensor S0 is thereby not taken into account, as in the case of rejection, i.e. when the rejection sensor S0 reacts, the corresponding currency bill reaches the rejection pocket 29a and is therefore no longer part of the continuing transport system.

The summary of the test results is useful, as a clear statement on the state and the genuineness of each currency bill can thus be made with one single data word. Thus, the results of all sensors are combined to generate the evaluation information by logical operations such that, with the aid of a simple decision table, each currency bill can definitively be allocated to one of the destinations within the sorting components 13-18.

In the following it will be explained how the stacking criteria are derived with the evaluation information comprising eight features, by means of a decision table stored in the file (D3) 365. For purposes of facilitation an evaluation information with two features only be used: a genuineness feature (E) and a state feature (Z).

In correspondence with the survey shown in fig. 7, components 16 and 17 (also see fig. 2) for rotatable currency bills (U-Bst.), components 14 and 15 for non-rotatable currency bills (HN-Bst.) and component 13 for shredding non-rotatable but genuine

currency bills (SD-Bst.) are selected as destinations. Moreover, E = log.1 means that a correspondingly evaluated currency bill was identified as genuine due to its genuinen ss features, and Z = log.1 means that th_ state of corresponding currency note was identified as usable or, respectively, rotatable. Currency bills identified as non-genuine, and thus suspected to be counterfeit money, are supplied to the manual refinish magazine 29b. At any rate they have to be treated with priority. Due to the selection of two features only, the evaluation byte, which serves as address for the table stored in the file (D3) 365, can adopt four different configurations, whereby, for example, for those currency bills whereof the evaluation byte 370 shows the configuration Z = log. 1 and E = log. 1, the destination of rotatable currency bills (U-Bst.) etc. is provided according to the chosen table.

By the use of different tables 381 it is now possible to produce any sensible combination between the currency bill features and the respective destinations. Thus, it is, for instance, easily possible to provide, for non-rotatable currency bills, not components 14, 15 (NU-Bst.), but component 13 for shredding the currency bills (SD-Bst.), so that the non-rotatable currency bills are not stacked but destroyed. On the other hand, it is likewise possible to use other criteria for the evaluation, and to evaluate the same, in response to the interpretation, by the use of a corresponding table 381 either as state or as genuineness feature. Moreover, it is possible, by inputting different decision tables and an alternately targeted selection of the same, to check different currency bill types and currencies in short succession one after the other. Thus, also the information-processing system is adapted to the modular structure of the transport unit and, thus, to the selection and combination of the components and to the processing of different currency bill types and currencies.

The input of the desired decision table 391 in the corresponding file (D3) takes place via the operating panel 9 connected to the system control unit 6.

The destinations determined on the basis of the test results and the decision table are likewise stored in the data record 366 of the respective currency bill, at the location "desired stacker" (fig. 4, 5).

The subsystems in the "desired stacker" decisions (NU_1/NU_2 or U_1/U_2) in the data record 366 of fig. 5, and the significance of the "actual stacker" decision, will be entered into below.

With the explanations about the derivation of the stacking criteria or the selection of the destinations on the basis of the data records 366 specific for each currency bill and set up during the passage of the same through the sensors S1-S8, the above-mentioned tasks of the first subsystem 345 of the transport control unit 6 have been described.

Thus, however, it has not yet been secured that each currency bill supplied to the transport unit is individually checked and maintains the path to one of the destinations determined by means of said check. For managing this latter task, a second subsystem 346 is provided in the transport control unit 6.

Second subsystem 346 of the transport control unit 6 (fig. 3, 4)

The second subsystem 346 has, in detail, the following tasks:

- It has to detect as to whether currency bills "accumulate" within the transport path due to the non-observation of the cycle interval, thereby forming a jam. In this case, the individual check as well as the transfer of the currency bills out of the transport system is obstructed or impossible. It may moreover happen that the package affiliation of the currency bills is disturbed and that currency bills are damaged inside the transport unit.
- It, moreover, has to take care that no currency bill exits the transport unit unregistered, i.e. without being registered, disappears out of the transport system or gets stuck at any location in the transport system.
- Finally, it has to monitor that the paths determined by the "desired stacker" decisions of the data records are maintained (switch position) and that the currency bills are transported through the transport system synchronously with the elements (switches, stackers) touching the currency bills.

The data sources of the second subsystem 346 are, according to fig. 3, 6, the light barri rs 85a ... in the currency bill transport system and a machine clock (MU) 371 for g n rating a basic cycle forming the reference time for all processes inside the sorting device. Additional data sources are the stacker pocket enable sensors (STF) 372a ..., which detect whether a stacker pocket provided for the storage moves synchronously with the transported currency bills, the file (D_1) 350 with the data records and a file (D_4) 373 for checking the execution time of the currency bills.

Data sinks of the second subsystem are the files (D_1) 350, (D_4) 373 also acting as data sources. Additional data sinks are control lines 374, e.g. for controlling the switches or for releasing an emergency stop.

The tasks of the second subsystem 346 of the currency bill transport surveillance are fulfilled by three surveillance mechanisms during the transport of the currency bills:

- Surveillance of the filling of transport sections,
- Surveillance of the execution time of currency bills in the transport system relative to the basic cycle of the machine clock 371,
- Surveillance of the path determined by the "desired stacker" decision (switch control) and the synchronism of the currency bills to be stored to the storage pockets of the stack in question.

Surveillance of the filling of currency bill transport sections (fig. 4, 8)

The surveillance of the filling of transport sections is necessary for the recognition of an accumulation of currency bills inside a transport section. The continuously running surveillance process, which is performed in view of all transport sections limited by two light barriers, be explained by the example of the transport section limited by the light barriers 85a, 85b (fig. 4). By the geometric distance of the light barriers and by the pulse interval (T_0) of the currency bills to each other – distance from front edge of currency bill to the front edge of the following currency bill – the number of those currency bills is defined, which maximally have room for a proper course between the respective light barriers of a transport section. An overfilling is now detected by

m ans of two counters connected to the light barriers, whereof the counter readings are constantly compared with each other.

For explaining the surveillance of the transport section filling (fig. 8) an initial state be defined, which is determined by that no currency bill has yet entered the above-defined transport section, and by that the counter 375 of the entry light barrier 85a of the corresponding transport path shows the counter reading "0" and the counter 376 of the exit light barrier shows the counter reading "1". If, in the case of said counter reading, the difference (D) of the counter readings is formed in a subtracter circuit 377 commonly provided for both counters, a negative value results stating that no currency bill is located in the indicated transport section. If the entry light barrier 85a now senses the first transported currency bill (BN_1) 382a, the connected counter 375 switches from "0" to "1". The difference of the counter readings is now D = 0, which can be interpreted in that a currency bill has entered the transport section. Corresponding to the currency bills located in the transport section the difference of the counter readings reaches a positive value: (D = 0).

If, according to the illustration in fig. 8, it is now possible due to the geometric conditions that the entry light barrier 85a registers a maximum of three currency bills 382a, 382b, 382c having entered the transport section before the exit light barrier 85b recognizes the exit of the oldest currer.cy bill (BN_1) 382a located in the transport section, the difference between the counter readings must not become larger than "2". ·f the difference does become larger than "2", the sorting process has to be interrupted, as the transport system is overfilled as a result of the aforementioned conditions.

Surveillance of the execution time of currency bills in the transport system (Fig. 1, 2, 9)

The surveillance of the execution time of the currency notes located in the transport system, relative to the basic pulse of the machine clock 371, is necessary for securing that each currency bill which has entered a transport section limited by two light barriers exits the same again after a specified "desired execution time". The desired execution time is thereby again defined by the geometric dimensions of the respective transport section.

According to the schematic illustration in fig. 9 the transport section limited by the light barriers 85a, 85b is to be used again for explaining the execution time surveillance.

Corresponding to fig. 9 the counter 375 (entry counter) connected to the entry light barrier 85a shows – on the basis of the above-defined initial position – the counter reading "0" while the other counter 376 (exit counter) connected to the exit light barrier 85b shows the counter reading "1". The counter reading of the entry counter 375 indicated when a currency bill enters the transport section shows the address of the connected execution time file (D_4) 373, in which the time of a machine clock 371 current at the entry of the currency bill has to be stored. The counter reading of the exit counter 376 indicates, on the other hand, from which address of the execution time file 373 the stored entry time required for the comparison has to be requested respectively so as to be able to perform the execution time surveillance for a currency bill having entered the transport section.

As all transport sections of the entire currency bill transport system have to be monitored in view of the execution time of the currency bills, the inquiry times for the individual transport sections are controlled by a higher ranking, cyclically organized inquiry program. The program, which shall not be specified in detail, is thereby configured such that a currency bill, as it passes through a transport section, is monitored several times at very short time intervals by a comparison of the actual execution time with the desired execution time, so as to be able to quickly react on an execution time error. During the individual surveillances it is detected whether the actual execution time, which is formed by the difference of the machining time current at the time of the inquiry and the stored entry time of a currency note, is shorter than or equal to the constant desired execution time for the transport section.

In the following the execution time surveillance in view of the transport section limited by the light barriers 85a, 85b shall be explained in more detail (fig. 9).

It is assumed that a currency bill (BN_1) 382a passes the entry light barrier 85a of the transport section in question at a time t_1. With the registration of the currency bill the connected entry counter 375 switches from the original state "0" to state "1". At the

same time, the machining time ($MZ_{t\,1}$) of the machine clock current at the entry of the currency bill is stored at position "1" in the execution time file (D_4) 373 connected to the entry counter 375. At a later time t [illegible][1] at which the currency bill (BN_1) 382a between the light barriers[2]. In correspondence with the counter reading of the exit counter 376 – which indicates the counter reading "1" – the entry time of the currency bill (BN_1) 382a stored in the execution time file 373 is, for this purpose, requested and is deducted from the machining time ($MZ_{t\alpha}$) current at the inquiry time t ($MZ_{t\alpha}$ – MZ_t). The difference forms the respectively current actual execution time (ILZ). As mentioned before, the same has to be shorter than or equal to the desired execution time (SLZ) ($MZ_{t\alpha} - MZ_t$ = SLZ). If the currency bill (BN_1) reaches the exit light barrier 85b at time t_2, the connected counter 376 switches from "1" to "2". According to the new counter reading the second currency bill (BN_2), which has meanwhile entered the transport system, is now monitored in view of its execution time. Due to the special initial state of the counter readings thus always the execution time of the respectively oldest currency bill located in the transport section is detected.

If the firstly mentioned currency bill (BN_1) 382a does reach the exit light barrier 85b within the demanded desired execution time, for example, because it got stuck in the transport system, the desired execution time will – in correspondence with the above-explained surveillance mechanism – soon be exceeded, which directly entails an interruption of the sorting process.

With the registration of a currency bill by the exit light barrier 85b the execution time surveillance of the currency bill is concluded in the transport section geometrically located upstream of the light barrier. As, however, the exit light barrier 85b of a transport section is simultaneously used as entry light barrier for the following transport section, the execution time surveillance for the subsequent transport section can be initiated by means of a second counter, which is likewise connected with said light barrier, and an additional execution time file – in fig. 9 illustrated as a dashed line.

Surveillance of the paths determined by the "desired stacker" decisions (fig. 3, 4, 10, 11).

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[1] Remark by the translator

[2] Sentence is incomplete

Within the scope of the currency bill transport surveillance it will finally be d scribed how the observation of the transport path to one of the sorting components specified by the "desired stacker" decisions is monitored.

In this connection the storage of non-rotatable currency bills in one of the components for non-rotatable currency bills, based on tandem operation, will be, as an example, explained in more detail by means of flow charts (fig. 10, 11).

If a currency bill (fig. 4) has left the measured length and, thus, the sensors S1-S8 in component 12 of the transport unit 2, it reaches – unless it is meant to be supplied to the shredder component 13 (is determined by the decision table) – the exit light barrier 85g of the shredder component 13. With the registration of the currency note by the exit light barrier 85g the "desired stacker" decision of the currency note in question is checked in view of its non-ability to circulate (BN:=NU?), namely in the data record of the respective currency bill – determined by the position of the pointer of the exit light barrier. See, in this respect, the flow chart "stacker selection" in fig. 10. If the currency bill's ability to circulate is detected, the currency bill reaches – which is not entered into in more detail – the subsequent components 16, 17 for rotatable currency bills. If, on the contrary, it is recognized that they are unable of being circulated, it has to be found at first which of the two components 14, 15 for non-rotatable currency bills is ready for the storage of the currency bill.

In the following, the first component 14 for non-rotatable currency bills will be designated with "NU_1-Bst.", and the second component 15 for non-rotatable currency bills with "NU_2-Bst.". For allowing the selection of the components, a so-called target counter (NU_1SZ or NU_2SZ) is allocated to each component 14, 15. The counter reading of the target counter indicates respectively how many non-rotatable currency bills were stored in the respective component 14 or 15. The difference over the desired number, which is specified by the capacity of the used component magazines 26, 27 for the storage of the currency bills, or by organizational guidelines of the currency bill processing, provides information on whether the storage is still to take place in the currently operating component or in the parallel component.

If – as is illustrated in the flow chart of fig. 10 – the inquiry for the reading of the target counter ($NU_1SZ = NU_1S?$) results in that the desired number has not yet been reached, the counter is increased by "1" ($NU_1SZ + 1$). With the latter mentioned inquiry the non-rotatable currency bill is destined for storage by component 14, which is correspondingly stored in the data record of the currency bill in question at the location "desired stacker": (desired stacker: NU_1-Bst.). If the target counter had already reached the desired number, the corresponding target counter of the following component 15 will be checked in another process step whether the same, too, has reached the desired number ($NU_2SZ: =NU_2S?$). If said counter has not reached the desired number it is increased by 1 ($NU_2SZ:=NU_2SZ+1$). In correspondence with component 14 the planned storage is stored in the data record of the currency bill in question (desired stacker = NU_2-Bst.). If, for some reasons deviating from the standard, also the second target counter has reached the desired number, the currency bill in question reaches a storage pocket of the last component 18 (HN-Bst.).

Upon the inquiry of the respective target counters it is, moreover, checked as to whether – in view of the mechanical operating mode of components 14, 15 – the storage is possible at all. It is, for instance, checked whether the switches of the components in question have previously been operative and whether the stacker has previously been ready for operation.

After the selection of component 14 for a non-rotatable currency bill, the switch control shall hereinafter be explained by means of the flow chart shown in fig. 11.

It is assumed that the currency bill in question has meanwhile entered component 14. Directly after its entry the currency bill is registered by the entry light barrier 85i of component 14 (fig. 4). With the registration it is now at first detected whether the corresponding currency bill actually corresponds to the currency note interpreted by the light barrier. If the light barrier has, for instance, interpreted the arriving currency bill by a skip of its pointer from n – 1 to n as nth currency bill, it is found by inquiring the data record of the nth currency bill whether an "actual stacker" entry is already provided or, respectively, whether the nth currency bill has, in this specific case, already been stored in the shredder component 13. In this case the currency bill is provided with an "actual stacker" entry. If the corresponding currency bill has already been

stored, the inquiry – and consequently the advanced setting of the pointer – has to be repeated until the data record with the missing "actual stacker" entry is reached, so as to find the correct curr ncy bill number. Thus, it is then secured that the pointer of the light barrier 85 points at a data record that belongs to the currency bill registered by the light barrier. In accordance with the flow chart illustrated in fig. 11, the inquiry whether the transported currency bill (BN) is to be stored in the first component 14 for non-rotatable currency bills (BN:=NU_1-Bst.?) can be effected. If the data record of the corresponding currency bill shows a "desired stacker" entry for component 14 (NU_1-Bst.), the synchronization (BN:=SYN?) subsequently takes place, which will be explained below.

If the currency bill moves synchronously to the intended storage pocket of the stacker 217a of component 14, the switch 83c of the component 14 is activated such that it transfers the currency bill out of the original transport section and guides it into the intended stacker pocket 217a ("switch":) NU_1-Bst., fig. 4). Directly prior to the storage in a stacker pocket, the currency bill passes through a last light barrier 85j in the transport section leading to the stacker 217a, whereby, finally, the following operations are performed.

- Increasing the "actual stacker" counter (NU_1IZ) by 1. The "actual stacker" counter indicates how many non-rotatable currency bills have really been transported to the first cmponent 14 (NU_1IZ:=NU_1IZ+1).
- Performing the "actual stacker" entry in the data record of the stored currency bill.
- Comparing the "desired stacker" entry and the "actual stacker" entry in the data record of the stored currency bill for checking the correct storage.
- Advancing the exit light barrier 85k of component 14, which corresponds to light barrier 85j, by 1, so that this light barrier, too, automatically registers the storage of the currency bill due to a pointer commonly provided for both light barriers.

As can be inferred from the flow chart in view of the "switch control" in fig. 11, the synchronism thereof is checked prior to the storage of a currency bill, as by maintaining a fast sorting process a currency bill can only be stored or stacked, if it moves

synchronously to the storage pock t of the s lected stacker in question. The synchronism is – as is explain d by means of component 14 – detected by the time interval of two signal (see fig. 12), namely by the signal 383 of the stacker pocket enable signal (STF-NU_1) and the signal 385 of the entry light barrier 85j of component 14, which appears at the moment a currency bill is registered.

The stacker pocket enable signal is a proximity test probe (not shown in the figures) on stacker 217a, which generates a signal when a storage pocket of the stacker adopts a defined position to the transport rollers of the transport section leading to the stacker, which are directly arranged in front of the stacker. If the signal 383 of the stacker pocket enable signal appears, and if synchronism is given, the signal 384 of the entry light barrier 85i has to be effected after a certain time interval within the tolerance range Δt 385.

This fact is schematically shown in fig. 12. The time interval of both signals is released by a counter 378 coupled with the basic pulse of the machine clock 371. With the appearance of the signal 383 the counter 378 is released. If the currency bill moves synchronously to the storage pocket, the front edge of the currency bill appears after the specified time within the tolerance range Δt 385 at the entry light barrier 35i of component 14, which then supplies the stop signal for the counter 378.

By means of an evaluating program it is finally checked, whether the counter reading as obtained lies within the tolerance range Δt . A counter reading being outside the tolerance range indicates an asynchronously moving currency bill, which his then, according to the flow chart shown in fig. 11, guided to the manual refinish magazine of component 18 (HN-Bst.) by a corresponding activation of the switch: ("switch":=NU_1).

When detecting that asynchronism is provided, it is noted in the data record of the corresponding currency bill that the currency bill is to be stored in component 18 for manual refinish currency bills (HN-Bst.) ("desired stacker:=HN-Bst.). Moreover, the alr ady previously set target counter of the first component 14 for non-rotatable currency bills (NU_1SZ) is set back by "one" (NU_1SZ=NU_1SZ-1) and a message relating

to the process is forwarded to the system control unit 7 (fig. 3) which, stored in the long-term memory 375 of the system control unit under the number of the packag , serv . s the generation of th . manual refinish protocol later.

Third subsystem 347 of the transport control unit 6 (fig. 3, 4)

The currency bills not stored in one of the sorting components 13-17 according to the above-described fashion reach the manual refinish magazine of the last component 18 of the sorting device. The currency bills of one package, together with the revenue stamp belonging to the package, are commonly stored in a pocket of the manual refinish magazine 29b – as had been explained in connection with the description of component 18 – if the following special cases occur:

- strongly damaged currency bills
- currency bills suspected to be counterfeit
- asynchronously incoming currency bills, and
- currency bills belonging to a package that shows an excessive amount (number of currency bills is larger than 100).

If a package shows an incorrect sum, or if there is a rejection case in a package, only the revenue stamp belonging to this package is stored in a pocket of the manual refinish magazine 29b. For being able to securely store revenue stamps corresponding to the respective input package together with the currency bills to be manually refinished, it is required that the transport of the revenue stamps is monitored and controlled.

The data sources of said third subsystem 347 of the transport control unit 6, which fulfills the above-mentioned tasks, are formed – according to fig. 3 – by the light barriers 86a ... in the revenue stamp transport system 32, the machine clock (MU) 371 for generating the machining pulse, the stacker pocket enable signal (STF) 372 of the stacker 217e, the file (D_1) 350 with the data records as well as the execution time files for currency bills (D_4) 373 and revenue stamps (D_5) 379.

Data sinks of the third subsystem are the file (D1) 350 with the data records, the files (D4, D5) 373, 379 for currency bill or rev nue stamp execution times and control elements 374.

Similar to the currency bill transport surveillance it is likewise necessary in view of the revenue stamp transport surveillance to monitor the fillings in the paths and the execution time of the revenue stamps. As the test mechanisms have been described in detail within the scope of the currency bill transport surveillance, this shall not be entered into in more detail. Therefore, the control of the revenue stamp transport in the case of an irregularity in a package remains to be explained on the basis of fig. 4.

As had already been stated in the description of the manual refinish component 18, the revenue stamp of the currency bill package being processed and located in the revenue stamp transport section 32 (fig. 4) of the penultimate component 17 is located – relative to the direction of transport – behind the light barrier 86j in a holding position. If there had been no error in view of the aforementioned test mechanisms (overfilling of path sections, execution time check), the revenue stamp temporarily stored in the holding position 32h must inevitably belong to the package being processed. It is now found out first at which time the last currency bill of a package had left the transport system in the most unfavorable case, i.e. when being stored in the pocket of the last component. The determination of the time "package end" is easily possible as the time at which the last currency bill of a package is individualized as well as the time which the currency bill maximally requires to possibly cover the longest transport route, are known (execution time surveillance).

If the time (package end) is reached, the revenue stamp transport section 32h of the penultimate component 17 is activated so that the revenue stamp can be taken over by the revenue stamp transport section 32i of the last component 18. Directly after the entry of the revenue stamp in component 18 it passes the entry light barrier 86j of said component, whereby the inspection of all data records of the currency bills belonging to the currency bill package just being processed is initiated according to manual refinish entries.

If one of the currency bills shown in its data record (see. fig. 5) a manual refinish note (HN) at the location "actual stacker", or if a manual r finish case is provided due to a smaller or excessive amount in the package or due to a storage in the first reject magazine 29a, the revenue stamp is transferred out of the original transport section 32i by a corresponding activation of switch 83g and is guided, via the transport section 33 and the stacker 217e, to the currency bill(s) already collected underneath the stacker on the stack formation and deflection mechanism 255. Together with the stored currency bills the revenue stamp is finally transported to a storage pocket of the manual refinish magazine 29b.

If, on the other hand, there is no manual refinish entry in the currency bill package just having been processed, the switch 83g is not activated, so that the revenue stamp is transported into a container 253 for proper revenue stamps.

Each time when the penultimate revenue stamp transport section 32h of component 17 is emptied by requesting the revenue stamps intermediately stored therein, the revenue stamps stored in the previously located transport sections 32g or 32f automatically follow up by the activation of the respective transport sections, so that the revenue stamp of the "current currency bill package" is stored in the penultimate transport section 32h by being accessible at all times.

Fourth subsystem of the transport control unit (fig. 3, 4)

Eventually, the fourth subsystem 348 of the transport control unit 6 be explained, which takes over the surveillance and the control of the mechanical periphery of the currency bill sorting device 1.

The control of the mechanical periphery units, such as the control of the manual refinish magazine 29b in component 18, is obtained by control elements (light barriers, switch etc.) which serve as data sources or data sinks and which, for all periphery units in fig. 3, are combined to form a block and are designated with position 386, as well as by file (D_6) 351 likewise acting as data source and data sink. The machining events relating to the periphery of the currency bill sorting device 1 are stored in file (D_6) 351.

Th peripheral mechanical units work, according to pure sequence controls, with relatively low switching times. Each of said units is a closed system in view of the necessary information processing, which is typically linked with the rest of th system only by 2 bits, initial instruction and a finish acknowledgment. As an example, the control of the manual refinish magazines be briefly explained (fig. 1, 4).

If there are irregularities in a package, always the revenue stamp as the last element of the package is stored on the stack formation and deflection mechanism 255 via the revenue stamp transport section 33, the stacker 217e. If the end light barrier 86l registers a revenue stamp in the revenue stamp transport section 33, the stack formation and deflection mechanism 255 is activated after a corresponding delay time, which transports the possibly accumulated currency bills with the revenue stamp into a provided storage pocket of the HN magazine 29b. This storage is registered via a light barrier, whereupon the pocket number of the storage magazine is identified so as to store the same together with the number of the package just being processed in the file (D_6) 351. Afterwards, the magazine is transported further until the next storage pocket is in the filling position.

Additional peripheral units are, for example, the package individualization station and the station for removing the revenue stamps in component 10, as well as the station for providing the revenue stamps 28 in components 16, 17, which is, however, not entered into in more detail.

With the fourth subsystem all systems 345, 346, 347, 348 of the transport control unit 6 have been described. Finally, the system control unit 7 with its peripheral units 8, 9 shall be explained.

System control unit 7 (fig. 3)

In contrast to the transport control unit 6, which monitors and controls the individual passage of currency bill packages, currency bills and revenue stamps through the transport unit 2, the system control unit 7 with its peripheral units 8, 9 carries through the entire organization of the currency bill processing in a processing shift. It takes care of the observation of the working process of the currency bill processing speci-

fied according to organizational provisions and is responsible for the communication with the operating staff by means of its periphery units.

Data sources of the system are the file (D_1) 350 and the file (D_6) 351 of the short-term memory, the long-term file (D_2) 357 and data input devices (keyboard 359, 360) at the manual refinish place 8 and at the operating panel 9. Data sinks are the file (D_1) 350 and the file (D_6) 351, the long-term file (D_2) 357 and data output devices (printer 361, 362 and the display device 363) at the manual refinish place 8 and at the operating panel 9. A processor (R) 358 is responsible for controlling the data flow between the data sources and the data sinks in accordance with the organizational provisions.

Already during the processing of a currency bill package, at the latest, however, after the final processing of the package, the system control unit takes over the data records belonging to the finally processed currency bills from file (D_1) 350, in which the data records of all processed currency bills are stored, and stores the same, by indicating the pertinent package number and the input container number, in the long-term file (D_2) 357, which may, for instance, be designed as a magnetic disk memory. Moreover, the data from file (D_6) 351 are taken over. With the data stored in the long-t rm memory the hereinafter listed protocols are, if need be, generated by the output devices (printer, display device) of the periphery units:

- the manual refinish protocol,
- the operation protocol,
- the shift protocol.

The manual refinish protocol is always generated when a magazine 29b in the last component 18 of the transport unit 2 is filled, or when other organizational guidelines are provided (e.g. package end). The protocol is then outputted by means of the printer 361 of the manual refinish place 8 and contains the following information:

- date and time of protocol issue,
- th number of the input container,
- the output of the processed curr ncy and denomination,

- the number of the packag containing an irregularity,
- the number of the manual refinish magazine (2. reject magazine 29b),
- the pocket number of the manual refinish magazine,
- the number of those currency bills showing a smaller or excessive amount,
- the number of those currency bills not corresponding to the currency just being processed or to the denomination,
- the number of those currency bills that are suspected to be counterfeit,
- the number of currency bills in the pockets of the manual refinish magazine in question,
- the number of currency bills stored as being usable or unusable and of the shredded ones,
- the indication of a rejection case by registration of the respective pocket and magazine no. of the rejection magazine (1. reject magazine 29a).

The filled manual refinish magazine is, together with the protocol, subjected to a concluding manual processing at the manual refinish place. Thereby, for example, those currency bills in a storage pocket, which, according to the protocol, belong to an "undetermined" input package (number of currency bills in the package could not be determined as result of a malfunction in the machine or multiple withdrawals) are manually counted and sorted. Under the identification number of the package the result is inputted in the long-term file (D_2) 357via the keyboard 359 at the manual refinish place 8 for completing the data of the package in question.

Next to the manual refinish place the printer 262 of the operating panel 9 outputs, if need be, an operation protocol, which gives information on human interferences, malfunctions in the machines or the causes therefor as well as on special instructions or test runs.

Current machining events such as the provision of new magazine containers or also the indication of malfunctions and the localization thereof are transferred to the operating staff via the data display device 363 of the operating panel 9, which allows a fast system diagnosis in cases of trouble.

It should finally be mentioned that a shift protocol is generated after the end of a shift (processing a det rminable number of input containers), in which the following data are listed:

- date and time indication of the protocol,
- Number of the processed input containers by indicating the respective container number,
- number of the processed input packages,
- indication of the currency and denomination of the processed currency bills,
- indication whether the respective container contents were complete,
- number of the total of the currency bills fed into the device,
- number of the currency bills stored as being usable or unusable or shredded currency bills,
- number of currency bills suspected to be counterfeit, and currency bills with incorrect currency or denomination,
- total number of currency bills showing a smaller or excessive amount.

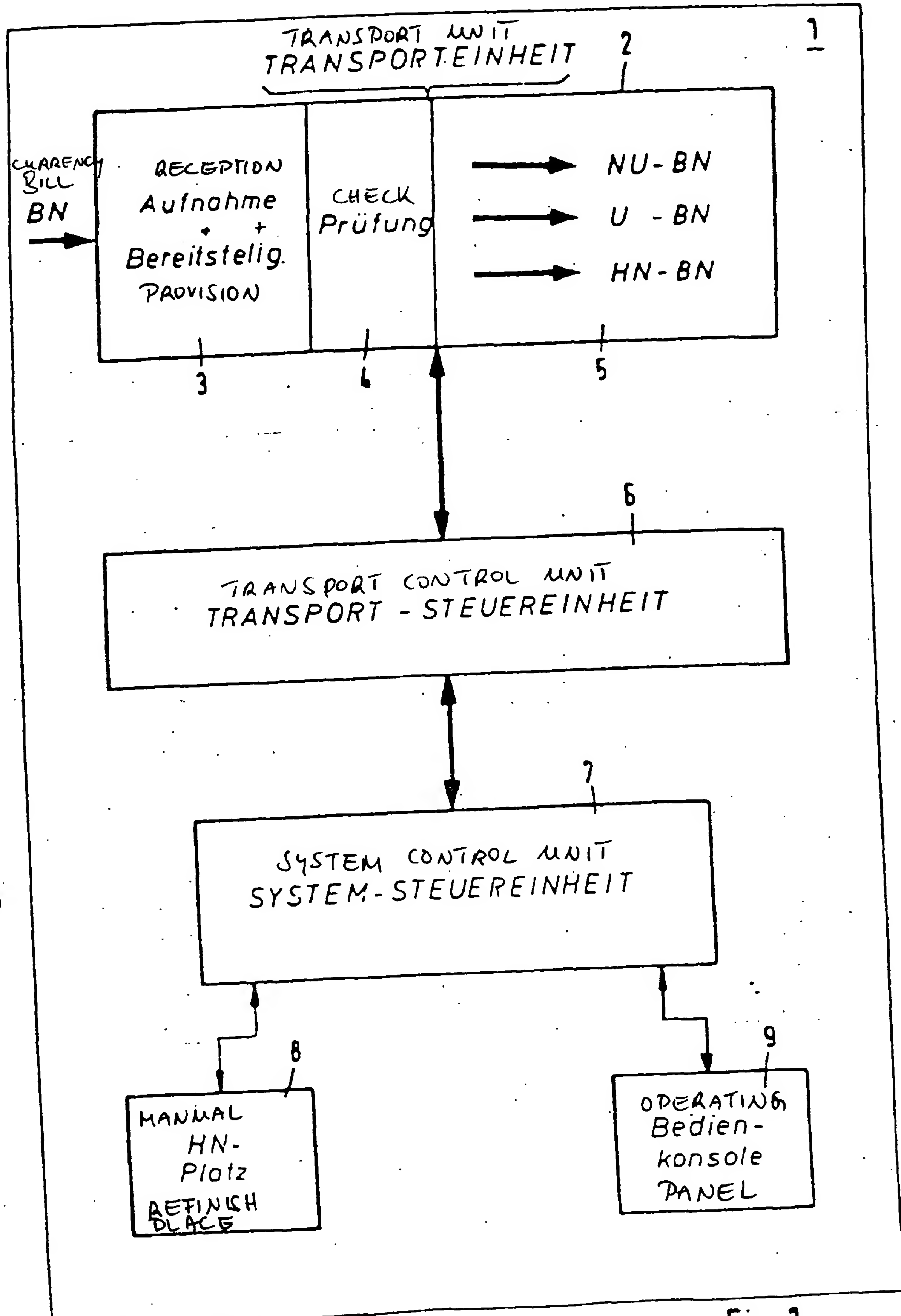
1
TRANSPORT UNIT
TRANSPORTEINHEIT
2
CURRENCY BILL
BN
RECEPTION
Aufnahme
+ +
Bereitstelig.
PROVISION
CHECK
Prüfung
NU-BN
U - BN
HN-BN
3
4
5
6
TRANSPORT CONTROL UNIT
TRANSPORT - STEUEREINHEIT
7
SYSTEM CONTROL UNIT
SYSTEM-STEUEREINHEIT
8
MANUAL
HN-
Platz
REFINISH
PLACE
9
OPERATING
Bedien-
konsole
PANEL

Fig.1

Nummer: 27 60 269
Int. Cl.⁴: B 07 C 5/38
Veröffentlichungstag: 5. März 1987

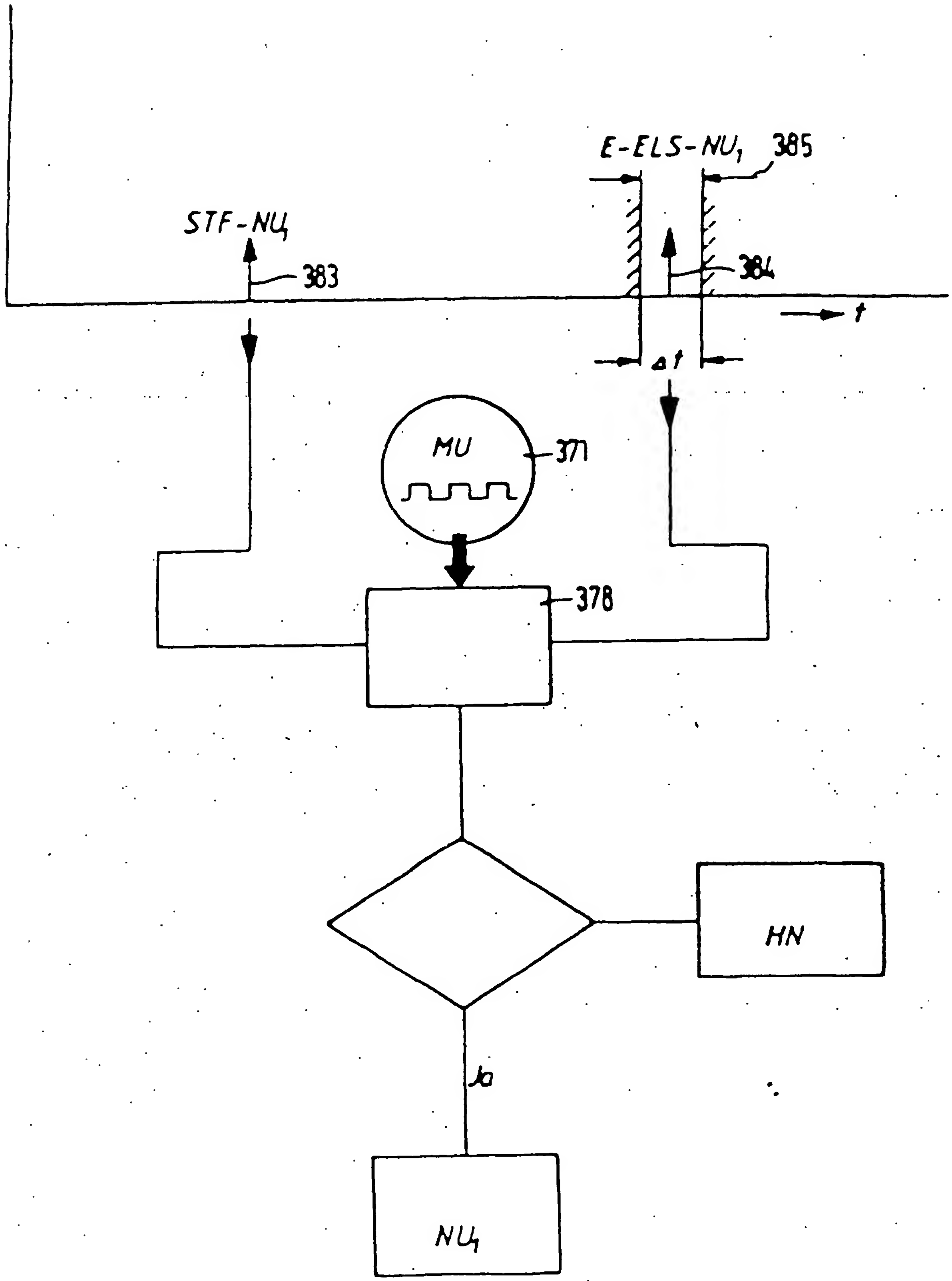

Fig. 12